Resource Allocation Planning

James Webb Space Telescope Project Deep Space Network Loading Assessment 2nd Revision - January 24, 2003 Roger Bartoo

Loading Study Description

This loading study covers the James Webb Space Telescope (JWST) project from Launch (August 1, 2011) through End-of-Prime-Mission (August 1, 2016). The work package consists of a tracking support plan with identified tracking resources and potential contention for tracking support with other missions operating on the Deep Space Network (DSN) within the same time frame.

The following restates the requirements identified by Section 920 and provided to the RAPSO. Requirements were provided to RAPSO verbally and by e-mail on January 6, and 7, 2003. These requirements were evaluated for the resources needed to satisfy them and a forecast of the supportable requirements was generated. A first pass, optimized support profile is established to minimize tracking and contention consistent with mission requirements.

This workable User Loading Profile for tracking support for the mission by phase are included below. No cost determination (aperture fees) was requested in this study.

Requirements

The requirements of the project are segregated into two mission phases.

Phases

Launch To Launch+90days

The nominal launch day for the James Webb Space Telescope (JWST) is August 1, 2011. The Launch phase includes all support from launch through launch plus 90 days. Coverage requirements are for 14 eight-hour passes per week during this period (week 31 through week 43). Nominal antenna setup (precal) times of 30 minutes with a 15-minute tear-down (post cal) time were used. All Maneuvers during this phase (e.g., Trajectory Correction Maneuvers) are assumed to be covered within the stated tracking requirements for the phase. It was assumed that there is no requirement for use of the 26-meter subnet for acquisition aide.

Launch+91days To End-of-Prime-Mission (EOPM) – Nominal Lagrange 2 Operations

From Launch+91days (October 31, 2011) to August 1, 2016, coverage requirements are for seven 3-hour 34-meter Beam Wave Guide 1 subnet passes per week with a nominal 30-minute setup time and 15-minute tear-down time. Passes are assumed to be alternating north-south passes (i.e., Canberra-Madrid or Canberra-Goldstone) utilizing two channels for X-Band up and

Ka-Band down. These daily passes continue until nominal End-of-Prime-Mission (EOPM) on August 1, 2016.

Tracking Support Assumptions

Ka-Band tracking support on the 34-meter Beam Wave Guide 1 Subnet (34BWG-1) is assumed (Cat A equipment for L1/L2 support is assumed only on the 34-meter BWG-1) with two channel (X-Band up and Ka-Band down) throughout the life of the mission.

Loading Profile

Figure 1 shows the user loading profile for the project. The profile covers the period from August 1, 2011 through August 1, 2016.

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FIGURE 1: James Webb Space Telescope User Loading Profile

Assessment

34-meter BWG 1 Subnet

Figure 2 shows the forecasted supportable fraction of requested time for JWST over its mission life (August 1, 2011 – August 1, 2016) on the 34-meter BWG-1 subnet. There is only 1 period where support drops below 95%. In late July 2014 (starting in week 30) through August 2014 (through week 35), JWST support varies from 76% of requested support to 81%. Some contention with the Mars 2013 mission's approach to Mars occurs in these weeks on the 34-meter BWG-1 Subnet. The current Mars Program place holder mission for launch in 2013 and Mars arrival in early September 2014 has requested 21 eight-hour passes per week for about 5 weeks starting in week 30 on the 34-meter BWG-1 Subnet. L2 view period overlap with Mars diminishes, however, during these weeks from about ~50% in week 30 to about ~30% in week 35. The contention for the 34-meter BWG-1 Subnet also drops. This study does not take into account the impact that future missions that are not yet identified will have on DSN loading (i.e., New Frontier missions, future Discovery missions, future ESA missions, etc.). At this time, support for JWST in the period 2011 to 2016 appears excellent. However, that is expected to change with time.

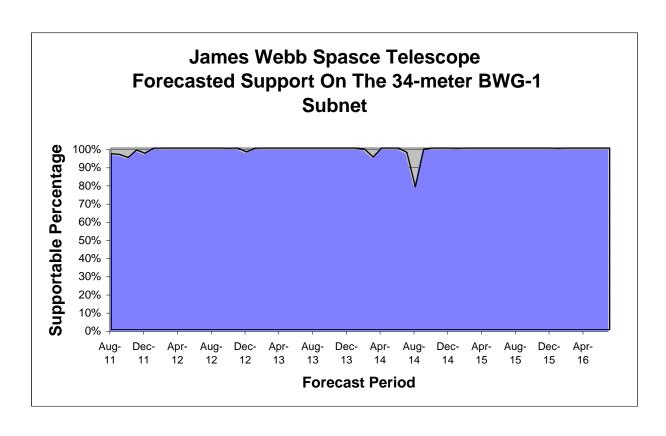


FIGURE 2: Forecasted Support for the James Webb Space Telescope on the 34-meter BWG-1 Subnet